

*Relation between length of wire and elevation of kite.*

Date.	Number of observations.	Average length of wire.	Average angular elevation.	Average elevation of kite.
		<i>Feet.</i>	<i>° ' "</i>	<i>Feet.</i>
June 27 .....	12	1081	38 0	637
July 1 .....	34	3547	33 30	1869
July 2 .....	16	2722	38 36	1565
July 3 .....	18	3979	44 42	2635
July 6 .....	22	4728	42 30	2865
June 27-July 6 .....	102			
Means .....		3211	39 28	1914

The average ratio of elevation to length of wire for all heights is a trifle less than 0.60. This value is based on 102 observations. The ratio varied but little throughout the experiments. The average ratio for 18 elevations exceeding 3000 was 0.59. The average angular elevation of the kite was 39° 28' for all observations, and 38° 30' for the 18 elevations exceeding 3000 feet.

**THUNDERSTORMS AT LINCOLN, NEBR.**

By JAMES H. SPENCER, Observer, United States Weather Bureau, dated Lincoln, Nebr., December 19, 1903.

The following extracts, revised to December 1, 1903, are from an article on Thunderstorms, by Mr. James H. Spencer, Observer, United States Weather Bureau, Lincoln, Nebr., which was officially published in the Proceedings of the Nebraska Academy of Sciences, Vol. VII:

Thunderstorms have more than usual interest to the residents of most of the States lying between the Mississippi River and the eastern slope of the Rocky Mountains. In this great region they probably supply not less than two-thirds of the precipitation during the summer months, and crop failure or success depends very largely upon their frequency, extent, and the amount of rainfall.

\* \* \* \* \*

Careful records of thunderstorms have been kept for Lincoln, Nebr., since April 1, 1896, and although a longer record is necessary to establish trustworthy averages for comparison, the statistics deduced from the record for the eight years ending November 30, 1903, particularly for the crop seasons will be found of interest.

The total number of thunderstorms passing over the station<sup>1</sup> for the entire period was 302, or an average of 38 for each year. About 50 per cent occurred during the night (from 7:00 p. m. to 7:00 a. m.) and about 70 per cent. between noon and midnight. Nearly 90 per cent. were recorded as coming from some westerly direction. Two hundred and forty-four of the 302 thunderstorms, or 81 per cent. of the entire number, occurred during the forty months of the eight crop seasons—from April to August, inclusive—the time of year in Nebraska when moisture is most needed. The distribution of the storms by years, and for the five months of the crop season, the total rainfall for each month, and the approximate amount which fell during thunderstorms, are given in the following table:

Thus it is found that about 70 per cent. of the total amount of rainfall for the crop season is due to the passage of thunderstorms, and that the percentage of rainfall from thunderstorms during the most critical crop months in Nebraska—July and August—is still greater. The average rainfall for each crop season, excluding that due to thunderstorms, was only 6.25 inches.

\* \* \* \* \*

The maximum wind velocity for the eight years, and the highest ever recorded for five minutes at Lincoln, was 80 miles per hour, occurring in the thunderstorm of May 12, 1896. No very great damage resulted from this storm.

The year 1900 furnished an unusual number of excessive wind and precipitation records for Lincoln. Both the number of thunderstorms and the rainfall were considerably above the normal. During the thunderstorm of July 15 over 3 inches of water fell, more than two-thirds of which occurred in one hour. A month later, on August 16 and 17, 4.27 inches of water fell in twenty-four hours, an amount more than 1 inch in excess of the normal rainfall for that month. During the thunderstorm of August 23, 0.61 of an inch was recorded in five minutes. At this rate our entire annual precipitation would occur in less than four hours. During the storm of August 21 occurred the highest wind velocity for the year, averaging 78 miles per hour for five minutes, but for one minute exceeding 100 miles per hour. Hundreds of trees were blown down

<sup>1</sup>The instructions for Weather Bureau observers require that thunderstorms be recorded when thunder is heard at the station, without reference to any other feature.—ED.

or had large limbs blown off and the roofs of a number of buildings were badly damaged.

The summer of 1902 also gave some very interesting thunderstorm data for Lincoln. The total rainfall for June and July was 20.18 inches, or within 6.58 inches of the yearly normal; of this amount 86 per cent. occurred during thunderstorms. The July rainfall was 11.35 inches, or three times the normal amount. It is interesting to note that of this amount only 0.89 of an inch occurred during the twelve hours ending at 8 p. m.

The thunderstorm of May 26, 1903, was the most destructive on record at the station. A maximum wind velocity of 76 miles an hour was recorded. About one mile southwest of the office the storm appeared to be even more severe, and several large buildings were damaged by the wind to the extent of nearly \$100,000.

*Thunderstorms at Lincoln, Nebr.*

Year and month.	Number of thunder- storms.	Precipitation (in inches).	
		Total for month.	Total during thunder- storms.
1896.			
April .....	3	4.57	2.62
May .....	8	10.11	4.20
June .....	5	3.05	2.43
July .....	4	5.63	3.92
August .....	3	3.39	1.77
Total for crop season .....	23	26.75	14.94
1897.			
April .....	3	6.15	2.96
May .....	3	2.22	1.32
June .....	3	2.17	0.63
July .....	0	2.54	0.00
August .....	5	2.69	1.82
Total for crop season .....	14	15.77	6.73
1898.			
April .....	3	3.88	0.22
May .....	4	4.33	2.90
June .....	3	3.99	1.26
July .....	3	3.93	3.69
August .....	3	3.45	2.68
Total for crop season .....	16	19.58	10.75
1899.			
April .....	4	1.49	0.87
May .....	12	2.29	1.57
June .....	11	8.39	8.35
July .....	4	1.47	1.15
August .....	6	2.66	1.74
Total for crop season .....	37	16.30	13.68
1900.			
April .....	7	4.33	1.44
May .....	7	4.50	4.14
June .....	11	2.50	2.44
July .....	9	6.66	5.78
August .....	7	9.07	8.91
Total for crop season .....	41	27.06	22.71
1901.			
April .....	1	1.46	0.53
May .....	3	1.96	1.69
June .....	9	1.42	1.24
July .....	5	2.94	2.83
August .....	7	1.02	0.78
Total for crop season .....	25	8.80	7.12
1902.			
April .....	3	0.67	0.11
May .....	9	3.65	1.34
June .....	11	8.83	7.20
July .....	13	11.35	10.21
August .....	7	4.35	3.87
Total for crop season .....	43	28.85	22.73
1903.			
April .....	3	3.59	2.73
May .....	12	10.72	7.57
June .....	7	2.60	1.32
July .....	11	3.07	3.07
August .....	12	6.45	5.33
Total for crop season .....	45	26.43	20.82
Total for 8 crop seasons .....	244	169.54	119.48
Average for each crop season .....	30.5	21.19	14.94

**RECENT STUDIES ON THE SOLAR CONSTANT OF RADIATION.**

By C. G. ABBOT. Reprinted from Smithsonian Miscellaneous Collections (Quarterly Issue), volume 43. Published December 9, 1903. (Revised by the author.)

**INTRODUCTION.**

Within the last two years the observations of the Smithsonian Astrophysical Observatory under the direction of the